APPENDAGE COVER

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Patent Application No. 60/463,756 filed on April 16, 2003, entitled "Appendage Cover," the disclosure of which is hereby expressly incorporated by reference.

FIELD OF THE INVENTION

The present invention relates generally to rehabilitative devices, and more particularly to appendage covers adapted to permit the covered appendage to selectively glide upon a surface.

BACKGROUND OF THE INVENTION

In the healthcare industry, a patient of limited mobility is often transferred from one location to another, such as from a wheelchair, bed, toilet, or car to another location. Although such an operation appears benign on the surface, it has been discovered that injuries can occur to both healthcare workers and their patients during the performance of the transfer. Potential for injury during the transfer is present in many forms, however one specific source of injury in particular has not been addressed by previously developed safety aids. More specifically, it has been found that during the transfer, a patient's foot of a weak or paralyzed leg sticks or catches on the floor, causing stress on the hip, knee, and ankle joints. As the healthcare worker continues to transfer the patient, the patient's foot remains "adhered" to the floor as the patient is rotated and moved from the wheelchair to the bed, resulting in the patient's leg becoming twisted, stepped upon, folded under the patient, etc. Adherence of the foot potentially causes injury to the patient, such as sprains, strains, and/or fractures. Additionally, the adherence of the foot upon the floor significantly increases the difficulty of the transfer, which can result in an

increase in injuries to the healthcare workers. Thus, healthcare workers are subject to injury during transfer operations, especially back injuries.

It also been discovered that injuries can occur to patients while using a wheelchair, most notably when a leg of the user has lost some degree of mobility, such as a result of a stroke. For example, it has been found that during the use of the wheelchair, a patient often propels the wheelchair with the unaffected leg while either dragging the weakened leg or supporting the weakened leg with a leg rest. In the situation of the weakened leg being rested upon the floor surface, a sole of a shoe worn by the user, or other such foot covering, has a tendency to adhere or grab the floor. The user is then injured as the foot is impacted and or twisted as the wheelchair continues to move forward.

Further, during the rehabilitation of an appendage, such as a foot or a hand, it is often desirable to slide the limb along a surface during performance of a rehabilitation exercise. However, it has been discovered that the skin of the appendage or appendage cover, such as a shoe, tend to grab or stick upon the surface, resulting in excess frictional forces and a jerking motion as the skin or appendage cover grabs and releases from the surface. These excess frictional forces decrease the range of motion that the patient is able to swing the limb through, thus decreasing the effectiveness of the exercise. Further, the resisting friction forces may be too great, potentially preventing the patient from even performing the exercise.

Thus, there exists a need for an appendage cover that permits the appendage to glide upon a variety of surfaces.

SUMMARY OF THE INVENTION

An embodiment of an appendage cover formed in accordance with the present invention for reducing surface friction of a weak or paralyzed appendage of a person to permit the appendage to glide upon a surface is disclosed. The appendage cover includes a body portion for covering at least a portion of the appendage. The body portion includes a grip surface positioned to engage the appendage and hold the body portion stationary relative to the appendage. The body portion also includes a glide surface positioned to slide upon the surface during movement of the person. The glide surface has a predetermined coefficient of friction sufficient to enable the appendage to glide upon the surface when (1) the appendage is resting upon the surface and (2) not bearing

the weight of the user and further sufficient to permit the appendage to remain immobile upon the surface when the appendage is bearing at least a portion of the weight of the user.

An alternate embodiment of an appendage cover formed in accordance with the present invention for reducing surface friction of a weak or paralyzed appendage of a person to permit the appendage to glide upon a surface is also disclosed. The appendage cover includes a body portion for covering at least a portion of the appendage. The body portion includes a grip surface positioned to engage the appendage and hold the body portion stationary relative to the appendage. The body portion further includes a glide surface positioned to slide upon the surface during movement of the appendage. The glide surface formed from a fabric of a predetermined fineness rating to enable the appendage to glide upon the surface when (1) the appendage is resting upon the surface and (2) not bearing the weight of the user and further sufficient to permit the appendage to remain immobile upon the surface when bearing at least a portion of the weight of the user.

A second alternate embodiment of a foot cover formed in accordance with the present invention for reducing surface friction of a weak or paralyzed leg of a person to permit a foot of the leg to glide upon a surface is further provided. The foot cover includes a body portion for covering at least a portion of a shoe donned by the foot. The body portion includes a grip surface positioned to engage the shoe and hold the body portion stationary relative to the shoe during use. The body portion further includes a glide surface positioned to slide upon the surface during movement of the leg, the glide surface formed from a fabric having a fineness rating of less than 400 denier.

A third alternate embodiment of an appendage cover formed in accordance with the present invention for at least partially covering a portion of an appendage of a user to permit the appendage to slide upon a selected support surface is disclosed. The appendage cover includes an outer surface oriented to engage the support surface when the appendage cover is worn upon the appendage, the outer surface having a predetermined coefficient of friction sufficient to permit the appendage to slide upon the support surface and to impede the adhering of the outer surface to the support surface. The appendage cover also includes an inner surface oriented to engage the appendage, the inner surface having a selected coefficient of friction higher than the predetermined

coefficient of friction to permit the inner surface to adhere to the appendage to impede the appendage from moving relative to the inner surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and many of the attendant advantages of this invention will become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is an isometric view of one embodiment of an appendage cover formed in accordance with the present invention, depicted worn upon a foot of a user;

FIGURE 2 is a top plan view of the appendage cover depicted in FIGURE 1, the appendage cover depicted in a flat, laid out position;

FIGURE 3 is an elevation view of the appendage cover depicted in FIGURE 2;

FIGURE 4 is a bottom plan view of the appendage cover depicted in FIGURE 2; and

FIGURE 5 is a cross-sectional view of the appendage cover depicted in FIGURE 2, the cross-sectional cut taken substantially through section 5-5 of FIGURE 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGURES 1-5 depict an illustrated embodiment of an appendage cover 10 formed in accordance with the present invention. Although the illustrated embodiment of the present invention is described as implemented for use as a cover for a foot of a user, those skilled in the relevant art will appreciate that the disclosed appendage cover 10 is illustrative in nature and should not be construed as limited to application with the foot of a user. It should therefore be apparent that the appendage cover 10 has wide application, and may be used in any situation where reducing the coefficient of friction of a body part, such as a hand, an elbow, a portion of a limb remaining after amputation, etc., is desirable. It should also be noted that for purposes of this disclosure, terminology such as forward, aft, left, right, etc. should be construed as descriptive and not limiting.

Referring to FIGURE 1 and generally described, the appendage cover 10 reduces surface friction and thereby allows a weak or paralyzed foot 14 to glide safely with the body, helping to eliminate stress placed on the hip, knee and ankle joints. The appendage cover 10 helps to reduce the risks of fracture, sprains, strains, and surprise twists caused when the foot 14 of a patient catches or sticks to the floor. The appendage cover 10 may be used to enhance transfer ease, ambulation speed and distance, leg control, joint

protection, and active muscle capability. The appendage cover 10 of the illustrated embodiment is designed to enable the caregiver easier and safer transfers, and to maximize patient mobility. The appendage cover 10 of the illustrated embodiment is durable, lightweight, portable and easy to use.

Referring to FIGURES 1-5 and focusing on the structure of the appendage cover 10, the appendage cover includes a flexible cover 12 adapted to substantially cover a foot 14 of a user, the flexible cover 12 removably coupled to the foot 14 by an attachment assembly 20. The flexible cover 12 includes an outer layer 16 and an inner layer 18. The outer layer 16 is suitably formed from a flexible material having a low coefficient of friction. The coefficient of friction is selected to permit the foot 14 of a moderate (50% to 75%) or maximum (75% to 100%) weakened leg to slide easily upon a surface, most notably flooring surfaces, without grabbing or "adhering" thereto while the foot 14 is in a non-load bearing position, i.e. a position wherein the limb bears substantially only the weight of the limb itself.

On the other hand, the coefficient of friction of the outer layer 16 is preferably not too low so as to permit the foot to bear the weight of the user without slipping out from under the user. In one embodiment, the leg is able to be angled up to about 10 degrees relative to the support surface while bearing the weight of the user before the foot slips out from under the user. In another embodiment, the leg is able to be angled up to about 15 degrees relative to the support surface and bear the weight of the user before the foot slips out from under the user. In another embodiment, the leg is able to be angled up to about 20 degrees relative to the support surface and bear the weight of the user before the foot slips out from under the user. In still another embodiment, the leg is able to be angled up to about 30 degrees relative to the support surface and bear the weight of the user before the foot slips out from under the user.

Preferably the outer layer 16 is made from a fabric, one suitable material being a nylon fabric, having a fineness rating of between about 100 denier and about 400 denier, with a preferred fineness rating of 200 denier. Although the outer layer 16 of the illustrated embodiment is described as a fabric made from a specific material, it should be apparent to those skilled in the art that the outer layer 16 may be formed from any number of materials, all of which are suitable for use with and within the spirit and scope of the present invention.

The inner layer 18 is suitably formed from a flexible material having a high coefficient of friction, the coefficient of friction selected to adhere to the foot 14 or a shoe enclosing the foot 14, such that the appendage cover 10 grips the foot and does not slide relative to the foot 14 during use. One suitable material for the inner layer 18 is a synthetic rubber, such as DUPONT'S® neoprene. Although the inner layer 18 of the illustrated embodiment is described as made from a specific material, it should be apparent to those skilled in the art that the inner layer 18 may be formed from any number of materials, all of which are suitable for use with and within the spirit and scope of the present invention.

Referring now to FIGURES 1, 2, and 4, the attachment assembly 20 includes an ankle attachment device 22, a hindfoot attachment device 24, and a midfoot attachment device 26. The ankle attachment device 22 couples the appendage cover 10 to the ankle or leg 28 of the user. The ankle attachment device 22 of the illustrated embodiment includes a left strap 30 and a right strap 32, each extending perpendicularly outward from a longitudinal axis of the appendage cover 10 at the aft end of the appendage cover 10. The right strap 32 may be joined to the left strap 30 around the leg 28 of the user through the use of a well known hook and loop fastening system. More specifically, the right strap 32 may include a portion of hook fabric 34 that engages a portion of loop fabric 36 disposed on the left strap 30, thereby removably coupling the appendage cover to the leg 28 of the user.

The hindfoot and midfoot attachment devices 24 and 26 are substantially similar in construction and operation to the ankle attachment device 22 described above with exception to their location on the appendage cover 10. As the name implies, the hindfoot attachment device 24 is coupled in proximity to a heel of the user, such that the left and rights straps, when coupled to one another, encircle the hindfoot portion of the foot, i.e. over the astragalus and/or scaphoid bones of the foot 14. The midfoot attachment device 26 is coupled forward of the hindfoot attachment device 24, such that the left and right straps of the midfoot attachment device 26, when coupled to one another, encircle the midfoot portion of the foot, i.e. over the metatarsal bones of the foot 14.

Although the attachment assembly 20 is described as formed from straps 30 and 32 utilizing a hook and loop fastening system for coupling the straps to one another, it should be apparent to those skilled in the art that the attachment assembly 20 may utilize

any number of well known fastening systems for coupling the straps to one another, such as buckles, buttons, clips, etc. Further, although the illustrated embodiment utilizes an attachment assembly 20 having straps for coupling the appendage cover 10 to the foot 14 of the user, it should be apparent to those skilled in the art that the other attachment assemblies are suitable for use with the present invention. For instance, the attachment assembly 20 may suitably include laces, zippers, elastic material, etc. for removably coupling the flexible covering 12 to the foot 14 of the user and are therefore within the spirit and scope of the present invention.

Referring to FIGURE 2, the appendage cover 10 further includes indicia 37 to mark the preferred placement of the heel upon the appendage cover 10 when donning. The indicia 37 may be visual indicia and/or physical indicia. Moreover, the indicia 37 may be formed in any number of manners, such as by printing an outline of the preferred location of the heel upon the inner layer 18 or sewing a line of stitching in a rough outline of the periphery of a heel as an indicator of the preferred location of the heel upon the inner layer 18.

Still referring to FIGURE 2, the appendage cover 10 further includes a left tether and a right tether 38 and 40 respectively. The tethers 38 and 40 are formed from a loop of thread passing through the flexible cover 12 and encircling a small portion of the flexible cover 12, "bunching up" the fabric in the location of the tethers 38 and 40. The tethers 38 and 40 thus aid in forming a hinge 42 in the flexible cover 12, the hinge 42 providing a preferential fold line. The hinge 42 thus aids in the folding of the rear portion of the flexible cover 12 up behind the ankle during donning of the appendage cover 10. Further, the tethers 38 and 40 create a reduced width portion 44 of the flexible cover 12, which aids in providing a visual indication of where the heel of the foot should be placed by providing a rounded section in the flexible cover 12 which generally matches the round shape of the heel of the foot.

Referring to FIGURES 1 and 2, in light of the above description of the structure of the appendage cover 10, the operation of the appendage cover 10 will now be described. In donning the appendage, the user lays the appendage cover 10 in a flat, laid out position as depicted in FIGURE 2, with the inner layer 18 facing the foot of the user and the outer layer 16 laying against a supporting surface, such as a floor. The user, possibly with assistance of a healthcare worker, places the heel of the foot in the location

indicated by the indicia 37, i.e. just forward of the hinge 42. The ankle attachment device 22 is fastened around the leg 28 of the user. A tongue 46 of the appendage cover 10 is then folded back upon the foot 14 so as to cover the top of the user's foot. The hindfoot and the midfoot attachment devices 24 and 26 are then fastened around the foot 14 of the user, thereby securing the tongue 46 against the foot of the user, and removably coupling the appendage cover 10 to the foot of the user.

Once donned, the outer layer 16 provides a reduced friction surface such that the foot may be easily slid upon most surfaces, such as most floor coverings, as the weight of the user is born by the users arms, other leg, and/or the healthcare worker. The low coefficient of friction of the outer layer 16 aids healthcare personnel in transferring a patient from one location to another, such as transferring a patient from a wheelchair to a bed. More specifically, the appendage cover 10 permits transfers to be performed without the foot of the patient grabbing or adhering to the floor during the transfer, thus reducing the potential for injury to the patient and healthcare workers as described above. However, the coefficient of friction of the outer layer 16 is sufficient to permit the outer layer 16 to grip the surface when the foot is in a load bearing position and supporting a least a portion of the weight of the user so that the foot does not slip out from under the user.

Further still, the outer layer 16 facilitates the performance of rehabilitative exercises by reducing the friction forces exerted upon the foot when slid upon a surface during performance of an exercise. More specifically, the appendage cover 10 permits the foot 14 to slide upon a surface, such as a floor, during rehabilitative exercises with reduced effort, thereby increasing limb mobility during the exercise. For instance, in one exercise, a user lays upon a pad and swings their leg to the left and right in a pendulum like manner upon the pad. Due to the reduction of friction, the arc which the user is able to swing the leg through is increased, enhancing the rehabilitative quality of the exercise. In some cases, the appendage cover 10 reduces the amount of friction to a point that permits the user to slide the foot across an exercise surface wherein such movement was previously impossible without the application of the appendage cover 10.

The low coefficient of friction of the outer layer 16, which permits a foot 14 wearing the appendage cover 10 to slide without grabbing upon a floor, is also advantageous for a wheel chair bound person. More specifically, the appendage cover 10

permits a user to push or slide ahead a covered foot 14 in front of the wheelchair when the foot falls off of a foot support platform of the wheelchair or when a foot support platform is not used. During such use, the appendage cover 10 impedes a shoe worn by the user, or other such foot covering, from adhering to or grabbing the floor resulting in the foot being impacted and or twisted as the wheelchair continues to move forward.

Although a few examples of exemplary uses of the appendage cover 10 are described for illustrative purposes, it should be apparent to those skilled in the art that the appendage cover 10 may be used for any activity where movement of an appendage with reduced friction upon a surface is desired.

The appendage cover 10 of the illustrated embodiment is an one-size-fits-all device. It may be worn upon a large foot, a small foot, a foot covered by a shoe, sock, or other covering, or upon an uncovered foot. As should be apparent to those skilled in the art, the attachment assembly 20, in coordination with the tongue 46, permits the appendage cover 10 to adapt to many different sizes of feet. Although the illustrated embodiment is depicted as an one-size-fits-all device, it should be apparent to those skilled in the art that alternately, the appendage cover 10 may also be suitably formed in any number of sizes, each size selected to correspond to a selected size of a foot.

Further still, although the appendage cover 10 of the illustrated embodiment is described as formed for covering a foot of a user, it should be apparent to those skilled in the art that the appendage cover 10 may alternately be formed to be donned upon alternate areas or appendages of the body. For instance, the appendage cover 10 may be alternately formed to cover a hand, wrist, elbow, head, back, ankle, calf, knee, thigh, leg, back, etc. of a user. It should be apparent to those skilled in the art that the size, shape, orientation, etc. of the flexible cover and attachment assembly may be varied from the illustrated embodiment to better accommodate the coupling of the appendage cover 10 to the desired portion of the body. Further, for the purposes of this detailed description, the term appendage includes any articles of clothing or other objects worn by the appendage such as a sock or a shoe covering a foot.

Further still, although the illustrated embodiment is depicted as worn upon the foot of the user, it should be apparent that the illustrated appendage cover 10 may be donned upon alternate areas of the user, such as about the hand, wrist, elbow, etc. of the user without modification.

While the illustrated embodiments of the invention have been illustrated and described, it will be appreciated that various changes can be made therein without departing from the spirit and scope of the invention.